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PROTECTION OF THE ATMOSPHERE: CLIMATE CHANGE

Report on Costing Exercises of measures adopted to limit possible climate changes

Report of the Secretary-General of the Conference

I. INTRODUCTION

1. This paper was prepared by the UNCED Secretariat, to respond to decision 1/11 (c) by the Preparatory Committe, requesting the "... Secretary General of the Conference to draw on, inter alia, the work of competent organs, organizations and bodies of the United Nations system, and other relevant organizations, in initiating appropriate work to estimate the cost, in particular to developing countries, of adopting measures to limit possible climate change and mitigate its adverse effects ... and to report thereon to the Preparatory Committee at its second session". 1/

2. The Secretariat would like to acknowledge the input of members of the Atmosphere Working Party of UNCED as well as other experts in preparing and reviewing this paper. 2/

3. Assessing the costs of CO_2 and other Greenhouse Gas abatement is fundamentally different, and more complex from other assessments, such as those concerning CFCs. While the potentials for GHG reductions are potentially very large, and given these potential energy savings often with negative costs (i.e., with benefits), their assessment is complicated by a number of factors. The scale of the part of the economy producing and using energy is so high that economic incentives implemented to, for example, increase energy efficiency, would have important macro-economic impacts. Since the policies would need to be applied for decades, the costs of fuel and technologies are difficult to predict.

4. These considerations, as well as the general political and economic importance of fossil fuels mean that establishing methodologies and assumptions for assessing abatement costs, and agreeing on a common framework for their analyses, will take a considerable effort both on the research and policy sides.

5. Much of the political debate on the greenhouse effect has focused on the credibility of large-scale climate models that are often used to estimate the effects of a trace gas build up on the composition and behaviour of the earth's atmosphere. Many of these models attempt to evaluate the impact of accumulating carbon dioxide and other gases on the earth's average temperature. Some models also evaluate other impacts, including the effects of global warming on precipitation, soil moisture, and sea level. These computer models have been subjected to intense scrutiny in the last several years, as scientists and policy-makers have tried to shape appropriate responses to the risks of rapid global warming. Major uncertainties, however, still remain.

6. In contrast, considerably less attention has been given to the models and methods used to assess the costs of reducing greenhouse gas emissions and the economic consequences of rapid climate change. This lack of attention is unfortunate, as economic forecasts carry considerable weight in policy deliberations. Recently, increased attention has been applied to the development of improved tools for understanding the costs of rapid climate change and the costs of various response strategies.

7. But even the best economic projections available today are not without major flaws. All suffer substantial limitations. The available economic models tend to emphasize the costs of response strategies while neglecting potential benefits. They ignore the complexity and diversity of the response of the natural environment to global warming. Most models neglect issues of distributional equity among regions as well as the impact on future generations of delaying responses. They often rely on dubious and untested assumptions about market forces and technological innovation. And they fail to explain the successful experiences of those countries, such as Japan, which have voluntarily maintained aggressive and innovative policies.

8. The application of improved tools for evaluating the economic consequences of rapid climate change will be particularly relevant to policy considerations in developing countries for several reasons. First, if no efforts are made to reduce the risks of rapid climate change, the negative impacts of global warming will be felt most strongly in the already-stressed societies of the third world. Second, since most future growth in demand for commercial energy is likely to come in these countries, increasing pressure will be placed on them to limit future emissions of carbon dioxide, both from energy use and from deforestation. Third, since many developing countries are likely to be chronically short of hard currency in the coming decades, anything which can be done to limit the extent of environmental damages and the capital demands of the energy sector will act as a spur for economic development, releasing desperately needed funds for other important purposes.

9. This paper provides a brief survey of recent costing studies and proposes some possible follow-up activities. The first section illustrates alternative definitions of the term "costs" and describes three types of costing studies currently in progress. The second section surveys the recent studies, grouping them by methodological approach and then by subject area. The third section lists some of the key institutions engaged in this area, separating the efforts of international agencies, national governments, NGOs, and others. The fourth section offers some specific suggestions for future activities that could fill some of the remaining gaps in knowledge.

II. DEFINING THE COSTS OF RESPONDING TO CLIMATE CHANGE

10. The term "cost" has been used with a variety of meanings in the recent discussions of the economic consequences of climate change. Some analysts have described the cost of a response strategy as the simple sum of direct investment costs. Using this definition, one could, for example, add up the production costs (or possibly the purchase price) of all the efficient light bulbs installed in residential dwellings plus the trees planted in agricultural areas, plus the new more efficient automobiles that might be purchased if a national commitment was made to limit the emissions of carbon dioxide (CO_2).

11. A more useful definition of the costs of responding to the risks of global warming focuses on the present value of the net investment costs of a particular strategy, relative to some reference strategy or baseline scenario. In this framework, the costs of installing efficient light bulbs, building higher dikes, constructing less energy-intensive industries, changing cropping and driving patterns, and planting trees might be subtracted from the costs of activities that would be pursued in each of these sectors, absent a systematic response to the risk of rapid global climate change.

12. A third, and perhaps more meaningful approach is to define the cost of a general response strategy as the measure of its impact on national, regional, or global GNP. Using this approach, the full social cost of the proposed strategy would be measured in terms of its impact on the estimated regional GNP and compared to the model's estimate of GNP for the relevant area before

implementation of the response strategy. Applying this approach in a complete and systematic manner, however, would require estimating the global economic consequences of climate change, including positive and negative impacts in the agricultural, forestry, and energy sectors, both with and without the proposed strategy - a difficult task for even one country over a multi-decade time horizon.

III. SURVEY OF COSTING STUDIES

13. In general, three types of costing studies have been undertaken in the last few years. These studies pose very different quetions and, not surprisingly, get very different results. The three principal types of studies include (1) assessments of climate impacts, (2) analyses of the costs of adapting to the impacts of global warming, and (3) studies of the costs of reducing greenhouse gas (GHG) emissions.

Climate impacts analyses

14. The first class of studies evaluates the impacts of climate change. These analyses are usually carried out as case studies of particular regions. They typically focus on one type of impact, which may be either a direct or indirect effect of climate change. Such studies may analyse, for example, the effects of sea level rise on a specific deltaic region close to the sea coast or the impacts of climate change on wheat crop production in a traditional agricultural area. Since the future distribution of regional impacts from global warming cannot now be predicted, these studies often assume a canonical view of a warmer world. The classical examples of such studies assume the equilibrium effects of doubling the pre-industrial concentration of carbon dioxide and proceed to estimate the regional economic consequences.

15. The best of such studies use either of two approaches. Some apply simulation models constructed from a hierarchy of biological or physical process models coupled to microeconomic models of typical enterprises and subsequently to regional economic models. Others start with a statistical analysis of historical data to elicit yield or impact relationships. These relationships are then applied to the estimated or assumed conditions derived from the regional climate model to project future yields or impacts.

16. Two types of impact assessment studies have been carried out in recent years, regional studies and national studies. Regional studies have been carried out to assess the effects of future climate change on agriculture, forestry, river basins, and coastal zone management. The most systematic and complete set of climate impacts studies were recently completed by an international team of experts working under the joint sponsorship of the United Nations Environment Programme (UNEP) and the International Institute for Applied Systems Analysis (IIASA). This project, investigated the effects of climate change on world agriculture. The study investigated the effects of doubling the pre-industrial CO_2 concentration on agricultural output from key regions in the United States, USSR, Japan, Finland, and a number of developing countries. Their results indicated that the most vulnerable

regions were likely to include (a) some semi-arid tropical and sub-tropical regions including western Arabia, the Maghreb, western West Africa, the Horn of Africa, and eastern Brazil, and (b) some humid tropical regions in south-east Asia and Central America.

17. Additional studies of climate impacts have been carried out by the governments of the United States, Canada, and Australia. These studies show substantial but not overwhelming damage in various sectors due to global climate change.

Adaptation Studies

18. Studies designed to evaluate the costs of adaptation to future climate change make up the second class of costing studies. Such analyses have also been often carried out as specific regional case studies. They typically concentrate on the effects of a particular class of impacts in a narrowly defined geographical region. Examples of this type of study include assessments of the costs of protecting low-lying coastal areas from salt-water intrusion due to sea-level rise and analyses of the costs of managing commercial forest plantations under changing and uncertain rainfall conditions. The amount of work done in this area has been limited to date. Some important analyses of the situation facing the United States was carried out by the Environmental Protection Agency as part of a Congressionally-mandated study of the impacts of rapid climate change. This study explored, for example, the costs of protecting two coastal United States cities, Charleston, SC and Galveston, TX, against the effects of a one-meter sea-level rise. Another important study was conducted for the Stockholm Environment Institute on the costs of adaptation to sea level rise in the San Francisco Bay. The Netherlands government has also done periodic studies of the costs of protecting that low-lying country against future increases in sea level. Similar studies could be conducted of the costs of protecting such cities as Bangkok, Alexandria, Shanghai, and Venice.

The Costs of Slowing GHG Build-Up

19. The most extensive and voluminous analysis has been done on the third group of studies. These analyses evaluate the costs of reducing the risk of climate change by slowing the build up of greenhouse gases. Such studies typically focus on the relationship between the use of commercial energy, especially fossil fuels, and the release of CO_2. On occasion, other greenhouse gases and other economic sectors (most often agriculture) are considered. Such studies can be broadly characterized into two general classes, based on the type of models employed. These classes are: (1) analyses using "top-down", macro-economic models and (2) analyses using "bottom-up", engineering models. To date, the results of such studies have been inconsistent with each other and generally inconclusive.

20. The "top-down" models typically incorporate representations of historical relationships among various economic sectors and do not provide much detail concerning the effects of new technologies or the impacts of changing behaviour patterns. This class of models often represent such changes through the use of aggregate macro-economic parameters which are difficult to measure precisely from available historical data, under the best of circumstances. These aggregate parameters include the average income elasticity of demand for energy, the elasticity of substitution between fuels, the rate of change in labour productivity, and the rate of autonomous energy efficiency improvement for the total economy or region. Using these parameters and extrapolating existing structural relationships many decades ahead, the "top-down" models tend to yield low estimates of the potential for emissions reductions and high estimates of the potential costs of those reductions.

21. There are four general types of "top-down" models, defined by their underlying structure. The four types include: (1) general equilibrium models that represent the energy sector as one of many dynamic sectors in the economy, all of which evolve over time; (2) partial equilibrium models that represent the energy sector in detail and the rest of the economy as an aggregated "black box"; (3) optimization models that start with a set of assumptions about the costs of various energy-related activities and seek an "optimum" pattern of activity that maximizes some goal or criterion; and (4) resource accounting models that map the physical and economic flows through the economy of a country or region.

22. Some illustrative examples of the "top-down" approach include: (1) the efforts by the United States EPA to develop a dynamic, intertemporal general equilibrium model called GEMINI; (2) a computable general equilibrium model developed at Stanford University that combines a non-linear optimization model and a macro-economic growth model; and (3) a dynamic general equilibrium model of the United States economy developed at Harvard University.

23. Despite the extensive activity in this field, a number of weaknesses and limitations beset these analyses. For example, in addition to the shortcomings noted above, many of the "top-down" macro-economic models often use a single number to represent the energy/GNP elasticity and do not allow this relationship to change over time. This remains common practice despite the historical evidence that this relationship has changed dramatically for most countries in the last 20 years. Furthermore, many such models rely principally on higher energy prices to bring about energy savings even though this requires using very high (and uncertain) estimates of energy price elasticities of demand. More importantly, they ignore the potential for policy-induced innovation. These models often make little provision for non-price induced energy savings measures such as performance standards or information programmes designed to overcome structural failures in energy markets.

24. "Bottom-up" engineering models focus on the characteristics of particular energy technologies. These models reflect detailed studies of the components

of each technology or the processes required to produce a specific product. They assume a rate of change in such key variables as the average energy and materials intensity of production. The total costs or savings due to deployment of the selected technology is treated as the arithmetic sum of the costs or savings estimated for each unit. They ignore the interactions between the technologies under examination and the rest of the economy or region. "Bottom-up" models tend to yield high estimates of the potential for reducing greenhouse gas emissions and low estimates of the total cost.

25. "Bottom-up" models can be divided into two groups. The first group are end-use oriented, cost accounting models in which the analyst identifies the "best" example of technology for a particular end-use and then the various end-uses are accumulated to represent the society as a whole. The second group are a family of optimization models in which the best set of process alternatives is selected from a range of choices to optimize the micro-economics of a particular activity.

26. A number of end-use oriented, "bottom-up" models have recently been developed in the United States and Europe. Some important illustrations include: (1) the work at the Lawrence Berkeley Laboratory that has been extended to 12 developing countries; (2) work at the Battelle Northwest Lab covering the Soviet Union and Eastern Europe; (3) work at the Center for Energy and Environmental Studies that has focused on the United States, Brazil, Sweden, and India; and (4) work at the Stockholm Environment Institute on a number of developing countries, as well as on the United Kingdom and Poland.

27. The "bottom-up" studies are also hindered by important short-comings, but of a different sort from the top-down models. These include lack of consistency in assumptions about fuel prices and discount rates, ambiguous and inconsistent methods for combining the effects of a number of measures or technologies - often ignoring their impact on the larger economy they are embedded within; inconsistent treatment of operations and maintenance costs; and finally a failure to integrate the economics of demand with those of energy supply.

28. Studies of the costs of reducing greenhouse gas emissions have been conducted at the global, regional, and national levels in the last five years. Most of the global studies have used "top-down", macro-economic models and run them out over a period of a century or more. The best-known examples of such studies are the scenarios produced by a joint Dutch-US modelling team for the Intergovernmental Panel on Climate Change, the United States EPA analysis conducted for the Congressional Climate Stabilization Study, the work of Swart and Rotmans for the Netherlands RIVM, the work of Edmonds and Reilly for the United States Department of Energy and the work of Mintzer for the World Resources Institute. A new global model is currently being constructed for the Commission of the European Communities (CEC).

29. A number of regional studies are now planned or underway. Most of these also employ a "top-down" approach. Such studies include an IEA/OECD study using a partial equilibrium economic model of the industrialized countries; and a detailed study of EC countries prepared by the CEC and employing a set of country-specific linear optimization models.

30. The largest number of studies have been done on a national basis. More than 20 such studies were prepared for the Energy and Industry Sub-Group of Working Group III of the IPCC. Most of these studies used top-down, partial equilibrium macro-economic models to project future energy use, CO_2 emissions, and GNP.

31. The Asian Energy Institute in New Delhi is co-ordinating a major study which would develop an extensive data base on variables related to greenhouse gas emissions; evaluate technology and policy options for their abatement; identify specific co-operative projects between countries of the region which would minimize overall emissions; and evaluate economic choices for the countries involved to reduce emissions. The Institute plans to have the results available by the end of 1991.

32. In addition, a number of other country case studies are worth noting. Environment Canada has recently published a study of the potential for achieving CO_2 reductions in Canada based on an analysis using an input-output model of the Canadian economy. A study is now underway for the Enquette Kommission of the German Bundestag to quantify the economic implications of the CO_2 reduction targets set by the German Government. In Norway, the State Pollution Control Authority is assessing the potential reductions achievable and the economic costs of 38 CO_2 eduction options. In India, the Indian Institute of Science in Bangalore has just completed a major study of alternative energy policies to the year 2000 for Karnataka state that includes estimates of potential efficiency improvements, fuel substitution possibilities, and CO_2 emissions reductions compared to the official state plan.

33. The key challenge is to integrate the results of the bottom-up and top-down approaches. This is essential in order to capture the technical specificity of the end-use oriented, engineering approach of the bottom-up work without losing the ability to see the economy of a country or region as a dynamic whole. No consensus now exists on the best method for meeting this challenge.

IV. INSTITUTIONS INVOLVED IN COSTING STUDIES

Regional Organizations

The Commission of the European Communities
The United Nations Economic Commission for Europe
The Association of Southeast Asian Nations

Intergovernmental Agencies

The World Bank
Asian Development Bank
Organisation for Economic Co-operation and Development
International Energy Agency
United Nations Environment Programme

National Governments

United States	Brazil	New Zealand
United Kingdom	China	Australia
France	India	Mexico
Federal Republic of Germany	Bangladesh	
Canada	Indonesia	
Netherlands	Malta	
Italy	Tuvalu	
Denmark	Saudi Arabia	
Sweden	USSR	
Norway	Switzerland	
Japan	Austria	

NGOs

Asian Energy Institute, TERI, New Delhi
Stockholm Environment Institute
Alliance to Save Energy, Washington
Natural Resources Defense Council, United States
Climate Action Network
Lega Par L'ambiente, Italy
Greenpeace
World Wildlife Fund, Washington, DC
Institute for European Environmental Politics
World Resources Institute, Washington, DC
Center for Global Change, Washington, DC
Battelle NW Labs, Washington, DC
Royal Institute for International Affairs, London
Bariloche Institute, Argentina
Africa Center for Technical Studies, Kenya
Bangladesh Institute for Advanced Studies, Dacca, Bangladesh

V. POTENTIAL AREAS FOR ACTION

34. Full advantage needs to be taken of the number of important opportunities which exist to advance the state of the art on the costs of responding to rapid climate change.

35. The most important activity would be to ensure effective coordination of existing studies, and to provide a common framework and data base for the evaluation of existing and future studies. The activity already under way in

UNEP with the co-operation of the Royal Institute for International Affairs in the United Kingdom is relevant. There needs to be good co-operation between this activity, the Secretariat of the Intergovernmental Negotiating Group, and the UNCED Secretariat.

36. In addition to coordination, a number of activities need to be strengthened or accelerated, including:

(a) more complete and thorough review of costing studies and their methodologies;

(b) the preparation of a compendium of impact assessments and adaptation studies, focused specifically on the cost implications of climate change for developing countries if no action is taken. Such an effort would bring together estimates of impacts from sea level rise, agricultural shifts, effects on forestry, and effects of changes in the timing, frequency, severity, and duration of extreme weather events with estimates of the costs of adapting traditional forestry, energy and agricultural practices;

(c) to support ongoing projects and encourage new ones, especially in the developing countries to assess the costs of climate change, such as the one being carried out by the Asian Energy Institute;

(d) a comparison of a "business as usual" scenario with a "no regrets" strategy using one or more of the major modelling tools now available. Such an effort should attempt to bring together a "bottom-up" and "top-down" approach to the overall analysis;

(e) a study to identify the geographic areas and industrial activities of greatest potential vulnerability to rapid climate change. Such a study could provide an alternative to the problems caused by excessive and deceptive aggregation in many previous impact studies which ignore the potential of severe, but localized, impacts.

Notes

1/ Report of the Preparatory Committee for the United Nations Conference on Environment and Development, Official Records of the General Assembly, A/45/46 decision 1/11, paragraph (c).

2/ The paper was based on a technical paper prepared by UNCED by the staff of the Stockholm Environment Institute.

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PROTECTION AND MANAGEMENT OF LAND RESOURCES: SOIL LOSS

Protection of land resources: an integrated approach

Report of the Secretary-General of the Conference

I. INTRODUCTION

1. The Preparatory Committee, at its first substantive session, in decision 1/15: Soil loss and desertification and drought, requested the Secretary-General of the Conference to examine and report on ongoing and future regional co-operation efforts in support of national programmes and plans for projects, including at the community level, that address land resources in a fully integrated development context. 1/

2. The conventional approach to land has tended to focus on single problems (e.g. soil erosion) or objectives (e.g. food production). For example, when focusing on environmental problems such as soil degradation, desertification or deforestation, the emphasis has usually been on technical solutions and socio-economic aspects are not given due attention. Likewise, development oriented activities such as agriculture or forage production have often ignored environmental considerations. There is also a tendency to treat each

issue as a separate problem, requiring a particular sectoral response, applied by a particular group of disciplines and specialized institutions, with the result that the interactions between different sectors and elements are largely ignored. In most cases this is too narrow a concept to integrate the whole range of environmental, social, cultural and economic issues that must be addressed to achieve sustainable development.

3. Present levels of environmental deterioration and the inability of economic systems to satisfy growing human needs, indicate that these current approaches are inadequate. A different approach is necessary: it is no longer enough to focus piecemeal on the various symptoms of environmental deterioration or lack of development. The request of the Preparatory Committee clearly suggests that a more comprehensive and integrated approach is required. But to develop this kind of approach a more thorough analysis appears advisable.

4. In this paper therefore the Secretary-General of the Conference has:

(i) examined land use problems and their root causes, identifying the fundamental issues and those areas where action is most necessary;

(ii) reviewed current actions aimed at better use of land resources, to determine to what extent they respond to the most important environmental and developmental requirements; and

(iii) suggested future directions which might be followed in addressing the management and use of land resources in an environmentally and socio-economically sustainable manner.

5. In examining these issues, it became apparent that it was necessary to include the entire range of land resources - the land itself, its topography and spatial nature; soils, water and biota - the living elements of the environment, including plants, animals and micro-organisms - as organised in ecosystems; the uses of land resources and competition between uses; the use of natural resources as inputs to the development process, viewed in the context of the broad range of development objectives - to achieve a better quality of life, to satisfy the needs of people for food, health and other basic requirements.

6. Because of the breadth of these considerations, it is clear that this kind of approach is relevant to work related not only to land resources as such, but also to forestry, freshwater resources; the conservation of biological diversity and management of living resources, the management of coastal areas; human settlements and other areas, as well as climate and responses to possible climate change. The demands made on the land, water and biotic resources of any given area, by the people who live there and by others, whether it be for food or sustenance, for industrial raw materials, for living and working space, for recreation or for any other purpose have to be balanced against the capacity of the resources. The development of a

general framework for action for the conservation, management and use of all natural resources in an integrated and holistic manner might be contemplated and developed in greater detail.

7. In preparing this report, the Secretary-General of the Conference worked closely with the relevant agencies of the United Nations system. Very useful suggestions and inputs were received, and have been duly incorporated here. In particular, it should be mentioned that the Food and Agriculture Organization (FAO) prepared an ad hoc discussion paper - "An Integrated Approach to Land Resources Management and Conservation", which contains much technically relevant material, and which has contributed significantly to the analysis presented here.

II. DEGRADATION OF LAND RESOURCES: THE PROBLEMS AND THEIR UNDERLYING CAUSES

The manifestations of environmental degradation

8. The problems affecting land resources are numerous and were clearly identified in the General Assembly resolution 44/228. Over the past decade, much attention has been given to these problems, and they have been described in major reports such as "Our Common Future", the Report by the World Commission on Environment and Development, 2/ and in the "Environmental Perspective to the Year 2000 and Beyond". 3/ Therefore, only a brief mention of these problems will be presented here, as a recall.

9. Degradation of the land and of terrestrial ecosystems is manifested in a variety of ways and includes problems such as loss and deterioration of soils, degradation of water resources and disturbances of the cycle and other specific occurrences, as well as damage to the major ecological processes and life support systems. These generalized processes of degradation of land resources and ecosystems occur through overuse or through practices unsuitable to the inherent productive capacities or characteristics of each system. These problems occur everywhere, but are most apparent in transition zones and other fragile areas, for example at the edges of savannas, coastal areas or in high mountain areas.

10. Degradation of biota may be apparent in terms of the variety and extent of vegetative cover as well as the number and distribution of animal species. This damage may result from overuse, through poor management of harvesting practices, from destruction of habitats or by external factors such as pollution. These processes result in the erosion of overall genetic diversity in populations and can lead to the endangerment and eventual extinction of species. This in turn affects the ecosystems involved, by damaging or changing the web of interrelations between all their components and causing deleterious imbalances and reduction in regenerative capacity.

11. Environmental pollution arising from agricultural, industrial or urban activities damages land resources in various ways, affecting both the land and biota, as well as the global environmental processes, such as climate, which

in turn affect land resources and terrestrial ecosystems. These problems also directly affect human health, either directly or through the contamination of resources such as soil, water, or food products.

12. Changes in land use and encroachment on productive areas or wildlands by developments, including infrastructure, settlements and industrial or mining complexes is also an important factor in the deterioration and loss of land resources. The geographical distribution of human activities and structures, (i.e. the pattern of human settlement), strongly affects and puts pressures on resources particularly those used daily by human beings - food, water, fuel. Human settlements also exert pressure on the absorptive capacity of ecosystems to assimilate wastes and pollution.

13. These manifestations of environmental problems have their economic and social counterparts - widespread poverty and unmet satisfaction of human needs for food, shelter and basic social amenities and services. As living standards and the quality of life decrease in those areas most reliant on the land - the rural areas - people migrate to cities in search of a livelihood, and transferring but not solving the problems of poverty. These social and economic phenomena in turn, also contribute to environmental deterioration.

The underlying causes

14. Increasing pressure on land resources is one of the most important factors in land degradation. This increased pressure has various causes, the most important of which is the growing number of people and the ever growing per capita consumption of resources and generation of wastes, particularly in the industrialized countries. A large and rapidly growing population, even with very low levels of consumption per capita, implies increased consumption in absolute terms. Land and water resources are finite in quantity and vary in their quality and ability to sustain various types of use. Improved management methods and technologies can extend productivity, but there is an ultimate limit to the productive capacity of the land, even with the most advanced technologies. Some of these limitations are extremely pronounced, as in the case of freshwater resources. Societies can develop these improved technologies, but social systems need time to adapt to changes. Because of the current high rates of change, unprecedented in human history, existing social and economic systems have not yet been able to adapt and land degradation has been the result.

15. Unresolved conflicts in the use of land and resources are another important cause of deterioration. These conflicts arise from the inability of present systems to balance the needs and requirements of different land uses and different groups. In attempting to cater for multiple demands on the land, there is a tendency to favour the most immediate requirements, or the requirements of the most powerful groups, and not enough attention is given to the long term implications of actions and to the use of appropriate management practices.

16. Conflicts arise when balancing the requirements of various land uses, the requirements of different development sectors and environmental requirements. The most important land uses include, among others those for: rural and productive purposes, including agriculture, pastoral production, fisheries, forestry; and those for urban and industrial purposes, including siting of settlements, industry, transport networks, mining, etc. Environmental services, such as the breakdown of wastes, the moderation of water flows and others must also be taken into account as must the need for preserving wild species and habitats in order to ensure the functioning and diversity of the ecosystem.

17. Conflicts also arise when balancing the interests of the individual, of specific groups and of society as a whole. The aims of these different groups have a different direction, scope and time span and they are inevitably difficult to reconcile. The aims of the individual are to obtain a livelihood, immediate survival being of paramount importance. This sometimes acts as a constraint to longer term considerations of environmental protection. Businesses aim to have a maximum return on capital, and have little incentive to protect the resource base because of the additional effort and cost this entails, without increasing the immediate returns. The interests of the community, on the other hand, may run counter to the immediate but not the long-term needs of the individual and groups, as it is to protect the environment and conserve the productive capacity of the land and of natural resources sustainably. The interests of nations and of the international community also vary and are difficult to reconcile, so long as only the short term or territorially limited interests are considered.

18. Behind the difficulty encountered in reconciling conflicting interests and requirements lies a basic lack of adequate knowledge of the nature of the interactions between the various factors, interests and requirements. Indeed, in many cases there is even lack of information on the most basic elements that should be considered in environmental and developmental management: for example, data on the current status of resources, ecosystems and development trends. A factor here is that the sheer amount of information necessary to build a working model for management purposes is daunting, and that gathering the information is not an easy task.

19. In traditional societies, balancing various land uses and interests was possible, because of the reduced scale of the actions, the small number of actors and their familiarity with the system within which action took place. Management systems became refined over the years, and responded to the needs of a relatively stable society - a society that was stable economically and culturally, because it experienced rates of change slow enough to allow for adaptation. Traditional village society did take an integrated view of the use of the land required for houses, for cattle, for fodder, for crop cultivation, for trees, etc. Settlements were planned, taking topography and nature drainage into account so that efficient waste disposal was possible. The needs of the individual and the interests of the community were reconciled through rules and other forms of social discipline. Diversification of land

use, in keeping with the differing capabilities of different types of land within the village, was the rule, not just at village level, but even at household level. An individual would be part farmer, part pastoralist, part forester, part fisherman.

20. The growth of population, the increased ability of humankind to modify its environment, the increasing complexity of social and economic systems, the pressures of commercialization, the lucrative opportunities opened up by new technologies, and the growing number of human activities that have characterized recent decades, have not been matched by a system of management that comprehends all their significant interactions. There has been a natural tendency to deal with these complex systems and interactions in what is seen as a manageable scale. This has led to the growing sectoralization of approaches, specialization and fragmentation of the management of land resources. But because of this simplification and fragmentation, the interrelationships between resources, the functioning of ecosystems and the achievement of sustainability have been lost from sight.

21. Institutions mirror this simplified and fragmented approach. There is a tendency to compartmentalize institutional responsibilities so that issues are dealt with in isolation and with little co-ordination. Legislation reflects these divided responsibilities and jurisdictions. Management methods are also predicated on the basis of a single resource or a single objective. At the highest level of government, policies also reflect this fragmentation.

22. Economic and social factors also contribute to the problems and shape the nature of the stakes people have in managing the land. The questions of ownership of land and resources, access to, and the right to use them, are of fundamental importance, not only for a more balanced and equitable development, but also to the level of care accorded the environment. It is only when people can satisfy their needs, have control over the resource base and have secure tenure to land, that the longer term requirements of environmental protection can be satisfied. At a broader level, economic relations between nations echo this situation as do trade patterns. A related problem which is rooted in economic thinking is the question of how to value resources and, in particular, ecological services. Traditionally, many of these resources and services have been considered as free goods. This thinking has been transferred to modern economic thinking which tends to consider only those elements to which a monetary value can be attached. Placing a monetary value on a resource that can be used as a commodity - such as timber - is possible. Placing a value on the forest itself, in terms of the services it provides in protecting the water cycle or as a function of ecological diversity, is more intractable. The result of this difficulty has been that these elements have been left out of the economic equation, profoundly affecting the care given to the environment and resource base.

23. Cultural attitudes to the environment, to land and its resources, and their management and use have also played a part. So long as predatory attitudes persist, so long as costs are externalized from sector to sector, so long as short term gains are given priority, the cycle of deterioration will continue.

Issues to be addressed

24. When examining the symptoms and underlying causes of land degradation and deterioration of natural resources, it is possible to identify those issues and action areas that need to be addressed if the problems are to be solved and a sustainable path to development embarked upon. It is clear that there are two fundamental issues that must be addressed. First, there is the question of pressures on the land and related issues of patterns of consumption and rates of population growth. This is perhaps the main issue facing the Conference and is being dealt with in other documents before the Preparatory Committee. It will therefore not be elaborated upon here. The other issue is that of the management process which includes land resources development, management and conservation. Essentially, this is the process through which decisions are taken by land users, society as a whole and governments, about how land is used. This process is the primary subject of this paper.

25. Various levels of the management process can be identified, where action should be focused, including:

(i) the highest level of policy and goal setting, where a greater integration of developmental needs and environmental requirements is necessary;

(ii) at the methodological level, where this integration must be given effective reality through a more thorough understanding of all interactions;

(iii) at the operational and technical level, where a more complete information base and better management procedures need to be developed;

(iv) at the institutional level, where more responsive institutions and procedures, based on greater horizontal co-ordination between sectoral departments and integration, need to be put in place;

(v) at the social level, where greater equality, participation and dialogue between the different actors must be fostered;

(vi) at the economic level, where better methods for assigning real values to environmental resources must be developed.

26. But beyond these elements, what is necessary is having a total picture, a framework for the sustainable development and use of resources - a framework that allows us to plan and review the use of land and natural resources in a holistic manner. This framework can then, in turn be supported by the appropriate methodological and institutional mechanisms that can make action possible.

III. OVERVIEW OF CURRENT ACTIVITIES

Major programmes of the international community

27. Many programmes and projects currently undertaken by the international community attempt to deal with the management of land resources in a more comprehensive and integrated manner than before, considering not only the environmental but also the developmental aspects. Because these activities are so varied, and because they cover so many different areas of emphasis, it is difficult to make an exhaustive list. Many of the activities that are relevant were described at length in the documents before the Preparatory Committee at its first session. 4/, 5/ It will therefore suffice to single out particularly representative approaches undertaken by various agencies of the system, which to one degree or another deal with the problems, causes and issues identified above. Emphasis is on programmes that promote an integrated approach to land resources. Those programmes or plans of action that deal with specific aspects of the problem (e.g. desertification) or specific land resources (e.g. forests) have not been included here. There has also been an attempt to refer to regional programmes as much as possible, but not limited to them. In keeping with these processes, below are described some of the most important programmes.

28. The Food and Agriculture Organization (FAO) is, by its very mandate, concerned with the management of land and natural resources for development. It is therefore the agency whose programmes are the most numerous and varied of those considered here. Its policies stress an integrated approach to water development, natural resource conservation and management, and the conservation and use of biological diversity. A multidisciplinary approach to land use planning is introduced through guidelines that provide a planning package for assistance to countries. Examples of action programmes include regional co-operation on land and water use in the Near East and support to the secretariat of the Amazon Co-operation Treaty. However, the most representative examples of regional, multi-sectoral activities that address land resources in an integrated development context are agricultural and rural development programmes in various regions, including Africa, Latin America and the Near East, as well as similar programmes in Europe relating to policies. A major programme recently launched that exemplifies an integrated approach is the Conservation and Rehabilitation of African Lands; similar programmes are foreseen for Asia and Latin America. The programme of Action on Agrarian Reform and Rural Development also has placed increasing emphasis on a more integrated approach. Geographic information systems (GIS) are being increasingly used to display the results of land resource inventories and support assessment and evaluation of land resources, ensuring an integrated approach to land use planning in on-going projects. Various core programmes have been undertaken, followed up by regional, sub-regional and national activities. Some that could be singled out are land use planning in Ethiopia, Lesotho, the Asia-Pacific region, and Costa Rica. Future actions will broaden the application of these methodologies to more countries and regional groupings, such as IGADD.

29. The International Fund for Agricultural Development (IFAD) has a specific mandate to increase food production, reduce undernutrition and alleviate rural poverty. IFAD provides loans on concessional terms to developing countries for community-based small-scale agricultural and rural development projects aimed at an explicit target group of small farmers, nomadic herdsmen and agropastoralists, artisanal fishermen, the rural landless, indigenous peoples, and poor rural women. In recent years, the Fund has adopted a strong focus on the linkages between environmental degradation and rural poverty, emphasizing the development of replicable approaches that seek to achieve a confluence between short-term production gains and longer term natural resource management concerns. In this regard, the projects funded under IFAD's Special Programme for Sub-Saharan Countries affected by Drought and Desertification provide important insights into the constraints and opportunities facing IFAD's target groups in their attempts to manage resources in a sustainable manner.

30. The United Nations Environment Programme (UNEP), after applying an "ecodevelopment" approach at the local level in the 1970s, has moved towards programmes of regional co-operation, such as the Environmental Action Plan for Latin America and the Caribbean or the Cairo Programme for African Co-operation launched by the African Ministerial Conference on the Environment (AMCEN). This last programme aims at strengthening regional co-operation directed to halting environmental degradation, enhancing the food producing capacity of the continent, achieving self-sufficiency in energy and rectifying the balance between population and resources. Of particular interest are the Pilot Villages and Pastoral Zones projects of this programme, which promote the integrated use of local resources for development. Other programmes which promote an integrated approach to resources include large regional lake and river basin management schemes, such as that for Lake Chad or the Zambezi River Basin, or the Regional Seas Programme, which focuses on the management of regional seas - including coastal areas. In this regard, the Mediterranean Action Programme, through its "Blue Plan", is a particular example of an integrated approach to natural resources, including land resources.

31. The programme on Man and the Biosphere (MAB), of the United Nations Educational, Scientific and Cultural Organization (UNESCO) provides the scientific basis to deal with problems of the utilization and conservation of resources and resource systems, emphasizing integrated and interdisciplinary research which has a direct and pragmatic application for improved land use and resource management. The programme is organized through sub-regional, regional and international research networks, along thematic or geographical lines, or a combination of the two; it includes projects in the humid and sub-humid tropics, arid and semi-arid and Mediterranean zones, as well as island systems, high mountain areas and ecotones, such as the interphase between land and inland water ecosystems.

32. The World Food Programme (WFP) provides food aid both for emergency feeding of victims of man-made and natural disasters and to support development activities. Its projects focus on the management of natural

resources, including those aimed at increasing agricultural productivity, supporting forestry activities, management of rangelands and construction of soil and water conservation works. Increasingly, there is an attempt to combine project components in an integrated way, both at the micro level, on individual farms, or at the macro level, for example in watersheds. Properly implemented, these activities serve both short-term production needs as well as long-term environmental needs. For example, forestry projects emphasize a broad approach that includes the growing of trees, the restoration of the natural forest, the use of forest products such as fruit, medicines and honey, managed fodder plantations and grazing in the forest. Watershed activities in China illustrate the potential for more macro-level planning. Hillside crop land is terraced to reduce soil loss and increase productivity. By upgrading every category of land in complementary ways, the projects make production from the watershed as a whole more environmentally sustainable.

33. The World Health Organization (WHO) executes a number of programmes that address particular aspects of land resources development as they relate to health. Its Environmental Health Programme (EHE), addresses problems associated with chemical pollution and with human health problems related to unsustainable resources management. The WHO/ILO/UNEP-sponsored International Programme on Chemical Safety (IPCS), is concerned with the health risk assessment of toxic chemicals, environmental health criteria, and poison control programmes. WHO is actively engaged in standard-setting for air and water pollution, collaborating with UNEP in GEMS' Air, Water and HEALS components, with major concerns in the area of global climatic change and acid deposition, which affect land and water biota as well as human health. The joint WHO/FAO/UNEP/UNCHS Panel of Experts on Environmental Management for Vector Control (PEEM), attached to the Community Water Supply programme of WHO/EHE, actively promotes the use of environmentally sustainable methods of health protection and vector control in irrigated agriculture and other water resources developments. The Onchocerciasis Control Programme (OCP), promotes sustainable land resources development in West African countries by eliminating river blindness. The OCP now covers 11 countries and is supported by 22 agencies and bilateral donors, including UNDP, FAO and the World Bank.

34. The World Meteorological Organization (WMO) deals with problems relating to the research in, and applications of, meteorology and operational hydrology to land and water-resource management. Various programmes such as the World Climate Programme, the Agricultural Meteorology Programme and Operational Hydrology Programme support this process. In particular, the WMO Commission for Agricultural Meteorology, through its various working groups and rapporteurs, has been active, often jointly with FAO, in studying the role and effect of climate on land-use practice and management in order to achieve sustainable agricultural production.

35. Other agencies of the United Nations system, such as the United Nations Development Programme (UNDP) and the World Bank (IBRD) are concerned with various aspects of land resources management for development purposes, focusing on agriculture, fisheries, forestry and others. In particular, UNDP has, over recent years, expanded environmental activities in its regional and

interregional programmes within a consistent programmatic approach and linked them with country activities, including those relating to conservation of biological diversity, forest management, range management, soil conservation, water resource management, wildlife management. Through its Sudano Sahelian Office (UNSO) it implements its most important programme directly related to resource conservation, focusing on fragile arid environments. UNSO has been instrumental in assisting countries to promote an integrated approach and in implementing the provisions of the Plan of Action to Combat Desertification.

36. Organizations outside the United Nations system, but working in collaboration with it, such as the IUCN, (World Conservation Union), have been promoting an integrated approach to the sustainable utilization of resources for development, through a comprehensive framework - The World Conservation Strategy. 6/ A successor to the World Conservation Strategy is currently being prepared, which places great emphasis on the integration of not only environmental and resource issues, but also on social and economic aspects. National conservation strategies are in various stages of development in over 50 countries. In addition, ecosystem based strategies have also been developed - for example, for wetlands - in a number of countries.

37. Many programmes and projects supported by bilateral international development co-operation organization and agencies also promote a more integrated approach to land resources. These include programmes dealing with rural development, watershed management, and semi-arid lands, soil conservation and others. Many mechanisms have been established at regional level which are making significant efforts to conserve, restore, and manage land resources. This includes a number of regional intergovernmental organizations in Africa which are undertaking important programmes to combat desertification, such as CILSS, IGADD, and SADCC, as well as programmes under AMCEN, COMIDES. Non-governmental initiatives, such as the Green Belt Movement launch a variety of programmes. Other regional programmes have specific components covering land husbandry. These include the Amazon Co-operation Treaty through its Commissions on Environment and on Science and Technology; ASEAN, through its Watershed Management Programme and SARC, under a programme of land use and river basin planning. CARICOM is developing a regional Tropical Forestry Action Plan. River basin commissions, such as the Mekong Committee and the Lake Chad Commission are developing integrated approaches to resource conservation management. Various international institutions conduct research that support aspects of this integrated approach, or deal with technical aspects of conservation, management and use of natural resources.

The response to the issues

38. From this brief overview of major programmes being undertaken at present, one can conclude that there have been some attempts, by national governments or the international community, to act at the policy level and deal with the use of land and natural resources in an integrated manner. Some more restricted approaches have been implemented over the past decade, notably through the development of national conservation strategies and environmental

action plans. It is difficult to determine conclusively how successful these attempts will be, but they do provide a broad framework within which projects can be more effectively planned and undertaken.

39. However, important action has taken place at the project level. These projects give a clear indication of the nature of most current approaches:

(i) most development action based on the use of natural resources is prdominantly sectoral; in those cases where more than one resource is managed, it is usually in the context of agricultural or rural development programmes which concentrate for the most part on management of soils and water;

(ii) there has been less emphasis on integrating all aspects of land resource management, because most projects are too small to allow effective scope; greater success has however been obtained in larger programmes - for example, ecosystem or area based programmes, such as those for watersheds;

(iii) there is an increasing, but still insufficient, effort to integrate developmental and environmental objectives - this appears to have been most successful in projects that have focused on eradicating poverty and ameliorating the living conditions of the poorest sectors.

40. Understanding of the interrelations between environmental and developmental issues has progressed over the years, as has the establishment of an information base, but much more needs to be done. It is necessary to widely disseminate existing planning and management methodologies. Gathering of basic environmental information must be stepped up and monitoring and assessment strengthened.

41. The technical basis for the management of specific resources is well advanced, although it is not always applied, mainly because of political and economic constraints in their application, but also because many of these solutions, while technically sound, do not always allow for the realities of the implementation process, where suboptimal conditions often prevail.

42. Social considerations have received increasing attention, but more needs to be done in terms of understanding social and economic interactions and understanding the influence of cultural perceptions on management of land resources. Furthermore, the fundamental mechanisms behind social participation in the development process need to be both further understood and acted upon.

43. An evaluation of representative activities currently undertaken could be useful in revealing how various elements have been successfully integrated within the existing development structure, and how specific procedures that make for successful implementation of projects, particularly at the local level, have been developed. While the extent to which current approaches

could be replicated is not clear, commonly accepted approaches or procedures could be widely applied. Indeed, many professional manuals exist that deal with aspects of resource management, and some of the United Nations agencies have developed a variety of guidelines which can be easily applied. But beyond this, there is no commonly accepted methodology for action other than broad strategic frameworks. This indicates that developing a more coherent and widely applicable set of common approaches and guidelines would be useful.

44. In summary, one can conclude that there is increasing progress in applying an integrated approach at the project level, but that there is ample room for continued development and strengthening of these programmes and projects. However, it is at the broader level that action is most inadequate. There is a need to promote a more holistic vision of development and environment and of the use of land and natural resources. This entails a new approach and, consequently, the redirecting of most current practices and institutions and greatly expanding the scope of current positive actions.

IV. PROMOTING AN INTEGRATED APPROACH TO THE CONSERVATION, MANAGEMENT AND USE OF LAND RESOURCES: THE MAIN ELEMENTS

Addressing the causes of unsustainable use of land resources

45. As discussed earlier, current actions tend to address the symptoms of environmental deterioration, but do not pay sufficient attention to those underlying causes that are at the root of the problems: increasing and diverse pressures on land resources; fragmentation and sectoralization when considering environmental requirements and the developmental interests of different groups; institutions and management systems that reinforce this fragmentation and result in unresolved conflicts; a general lack of understanding and of information on the essential elements that must be considered. In order to achieve the sustainable development and use of land resources, these issues must be addressed as a matter of priority, through an integrated approach to the conservation, management and use of land resources.

46. The very basis of the approach is that it must stress the explicit integration of environmental and developmental factors at all levels. It must start at the policy level, taking account of all components of the environment and all developmental factors. The integration of environment and development can best be approached by setting multi-functional goals that will simultaneously satisfy human needs while protecting the environment. It is advisable to do this explicitly at all levels - starting at the policy level and progressing to the level of action. The essential factors can be taken into account by observing some principles. The basic principles that must be taken into account when considering the social and economic aspects of the development process are that the benefits and costs of development are equitably shared, and that all people participate in the decision making process. The basic principles that must be taken into account in protecting the environment are that environmental processes and interaction are respected and that the resource base be used in a manner that is sustainable and such

that its richness and diversity is protected. These principles should be at the basis of all actions that concern environmental and developmental issues.

47. To be understood and applied worldwide the integrated approach to the conservation, management and use of land resources, must be simple and logical, and be articulated in such a manner that the various causes of unsustainability be addressed directly, that the different sectoral areas and interests are accounted for and the different levels of responsibility fully involved. An integrated approach would be, first and foremost, a broad methodological tool that would assist in the harmonization of different interests and requirements and in the co-ordination of different actions. To do this effectively three main areas should be given priority:

(i) people's participation;

(ii) more appropriate and responsive institutions, management structures and delivery systems;

(iii) an improved management system.

People's participation

48. Individuals are often well aware of their immediate surroundings and the area in which they live. They are not only familiar with the resources and particular characteristics such as climate, but also environmental deterioration. They are also often aware of the immediate causes. People also know their needs and capacities, and act upon them to satisfy their needs. Communities have successfully managed their common resources in the past, and could do so again, either independently or in partnership with their governments. To do so, it is essential to tap the understanding and knowledge of people to reach wise decisions. It is also imperative to enlist their support for implementation, by harnessing their enthusiasm and work potential. At present, development and resource conservation issues are perceived, by both the government and the population, as the responsibility of government agencies. Individuals or families see themselves as having no power to intervene, contribute, or make their voices and opinions known. For the situation to change radically, people and local communities must be assisted and given the means to participate and act upon their decisions. But they must first be given control of resources and convinced beyond doubt that they have the power to make and implement decisions.

49. To initiate development and conservation through, and based on, people's participation, it is important for people to be informed and involved. This could be done by providing for:

(i) information on the theme of natural resources, and their basic importance to the community and household in terms of satisfaction of needs and the quality of life;

(ii) participation in public debate on both general and specific environment and natural resource issues, including review of public policies and projects.

50. Participation in decision making at various levels, but particularly at the local level, can be encouraged by:

(i) inviting people to propose projects, programmes and measures for development, management and conservation of natural resources;

(ii) appraisal and discussion of these proposals and proposed measures with the groups putting them forward, and agreement on which should be implemented and how;

(iii) provision of technical, material or financial assistance by the government when requested and when justified.

51. A priority here is to include this type of initiative in all programmes that deal with land and natural resources in the first instance. More important in the long term, these kinds of procedures should be institutionalized and extended to other areas of decision making.

Institutions, management structures and delivery systems

52. Appropriate institutions, management structures and delivery systems are essential to support the process of conservation, management and use of land resources, and, in particular to facilitate integration of the various factors and also to allow for a greater openness in the management process. These institutions, structures and systems must respond to a range of needs, including for:

(i) principles and policies that promote and support the integrated management of land resources;

(ii) co-ordination and co-operation among the institutions with mandates related to land use;

(iii) a legal framework, regulations and directives that support the implementation of policies and approaches;

(iv) a planning process that is responsive to change, stresses anticipatory approaches and allows integration and judicious tradeoffs;

(v) delivery systems that give greater support to both social and environmental objectives and foster full participation of all actors.

53. Decentralization of authority for the implementation of land use policies, is essential for ensuring that local conditions are adequately taken into account. Since the primary level in the management structure could be a

representative council for the agro-ecological unit corresponding to the village, parish, ward, municipality or its equivalent. This is the level at which control over land use could be exercised. The basic functions of the council would be to identify priorities, allocate resources, make or approve plans, monitor implementation and make by-laws. The second level could be a similar council at district or equivalent intermediate level. Its functions would be similar to the village council with the additional responsibility of establishing a long-term land use plan and, if required, a zoning system. It could also be the focal point of technical expertise which would be needed for this purpose. At the national level the primary task is to provide a focal point for the development of an appropriate legal framework and for supervising and co-ordinating the work of the district and village councils. The institutional structure devised for this purpose must ensure that land use policies and development planning are fully integrated.

54. A few words should be said about the different levels where actions take place, and where reconciliation of interests and co-ordination of actions must take place. Each of these levels has different needs and objectives, a different level of impact, different jurisdictional responsibilities and, indeed, possibilities for action. Thus the same sort of dilemma is faced at each level - how to optimize attainment of objectives on a sustainable basis with available resources, and except for the differences of scale and complexity, the process of decision making is in essence basically similar and has different components both technical and institutional. The levels include:

(i) local level, including the community and social actors, both individuals and groups or corporations;

(ii) regional or district level;

(iii) national level;

(iv) international or global level.

55. The priority here is to first review the existing institutions, structures and systems to determine how well they respond to the needs of a more integrated, holistic and democratic approach, secondly, modify those aspects that are inadequate and third, strengthen and create new ones.

The management system

56. The management system has various facets and levels that facilitate the process of conservation, management and use of natural resources.

(i) At the most basic level is information on the various components of the environment and land resources, on their interactions and the uses to which they can be or are being subject to; it should be emphasized that correct decisions cannot be made without this information;

(ii) at an intermediate level are the various techniques and methods for assigning value and determining costs and benefits, impacts and tradeoffs; these techniques also allow the integration of the information on physical, social, economic and political factors, so as to take them all into account when deciding on the best uses for the land;

(iii) finally at the more general level, there is the body of technical information, knowledge, techniques and management methods that are brought to bear in regard to specific aspects of the management process. These allow for the most appropriate management of specific activities or resources.

It should be noted some of these elements of the management system are already in place, but must be further developed and strengthened. It is also important to increase human resources in the different disciplines and management actions. The area is vast and therefore the points described below are not exhaustive; they are merely intended as an illustration.

57. The most basic information that is necessary can be obtained through detailed inventories and through a continuous process of monitoring and assessment, and through remote sensing, ground data and the normal process of statistical analysis of the development process. Use of computer analysis and Geographic Information Systems manipulation is an important support for using this type of data meaningfully. This would include, among others, information on:

(i) the status and processes of change of natural resources and basic ecosystem components, including soils, forest cover, wildlife, as well as climate and other factors;

(ii) ecosystem forms and land capability, including that under different management conditions;

(iii) present land use and trends and changes, including for productive and non productive uses;

(iv) socio-economic factors, including human and other development indices, consumption patterns and others that can be correlated to the environmental information.

A more complex type of information which is related to these different categories refers to interactions between different components. It is more in the nature of scientific knowledge and understanding of environmental and social systems. Techniques of systems analysis and modelling can support the process of both acquisition and analysis of this information.

58. At the international level, there are a variety of techniques to support the process of decision making as to various possible uses of land, determining the value that should be assigned to different functions and

courses of action, determining tradeoffs and means of balancing different requirements can all be assisted by different management techniques. They range from ecosystem and land evaluation and agro-ecological zoning, to environmental impact or risk assessment, cost benefit analysis, and more complex methods for land use planning.

59. At the more general level, particularly that which refers to sectoral management, there are a variety of approaches, techniques and management methods that allow for the management of specific aspects, ranging from the use of a particular resource - for example water, in all its uses and functions; to the management of a productive activity, such as agriculture in all its facets; to managing a complex structure and process, such as a settlement. Very detailed guidelines exist in these and other fields and need not be elaborated upon here. The real need however is for methodological approaches that integrate these highly developed sectoral guidelines so that an integrated view of land, water climate and biota resources is reflected in specific decisions.

60. An important support to the management process is the establishment of a systematic decision making sequence, which would be relatively simple; but could cover all the necessary steps in each case. As an example, the following steps could be followed:

(i) identification of land resources in terms of distribution, quality, potential use and present human activities and structures;

(ii) identification and quantification of needs and requirements in developmental and environmental terms;

(iii) identification of management units, such as ecosystems or agro-ecological zones;

(iv) allocation of uses, making decisions on the optimum land use or combination of uses in relation to needs and objectives;

(v) monitoring and evaluation of the actions undertaken, determining their sustainability and deciding on corrective actions if necessary.

61. A priority in improving the management system is to strengthen the process of gathering, assessment, storage and dissemination of information; support methodological development and further develop techniques for handling specific environmental and developmental issues. Another priority is to actively apply this information, management methods and techniques at every level. Finally, the training of people in these applications must also have priority.

V. POTENTIAL AREAS FOR ACTION

62. Many of the actions necessary to address the most important elements of an integrated approach to the conservation, management and use of land resources should be developed and set in place at the national level. They are therefore in the exclusive competence of national governments. However, an international agenda for action could be envisaged, that would have a dual purpose, namely, on the one hand, to support national governments in developing the elements necessary to institute a more integrated and holistic approach and on the other, to ensure that these elements are taken into account in the programmes of the international community.

63. In this context the Preparatory Committee may wish to indicate its views on:

(i) the way in which existing programmes, as outlined in paragraphs 27 to 37, could be strengthened and restructured; and, in particular:

- how these programmes could be used to improve the management of regional land resources

- how these programmes could be used to assist governments in setting in place a more coherent system of planning, management and implementation for land resources at the national and local level;

(ii) the elements of an integrated approach as outlined in paragraphs 45 to 61; and in particular:

- whether and how this approach could be applied to the management of natural resources in general

- how the specific elements could be developed in respect of the management of land resources;

(iii) priorities for new programmes at the international level; in particular:

- for achieving the integration of environmental and developmental factors in the use of land resources

- for promoting peoples participation in the decision making process in respect of land resources

- for developing more responsive institutions to deal with an integrated approach to the management of land and natural resources

- for developing and applying better analytical and management techniques.

Notes

1/ Report of the Preparatory Committee for the United Nations Conference on Environment and Development, Official Records of the General Assembly, A/45/46 decision 1/15, paragraph I(d).

2/ Official Records of the General Assembly A/...

3/ Official Records of the General Assembly A/...

4/ Report of the Secretary-General of the Conference, A/Conf.151/PC/5.

5/ Overview of System-wide Activities Relevant to General Assembly Resolution 44/228 - Note by the Secretariat.

6/ World Conservation Strategy (1980) IUCN in co-operation with UNEP and WWF and in collaboration with FAO and UNESCO.

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